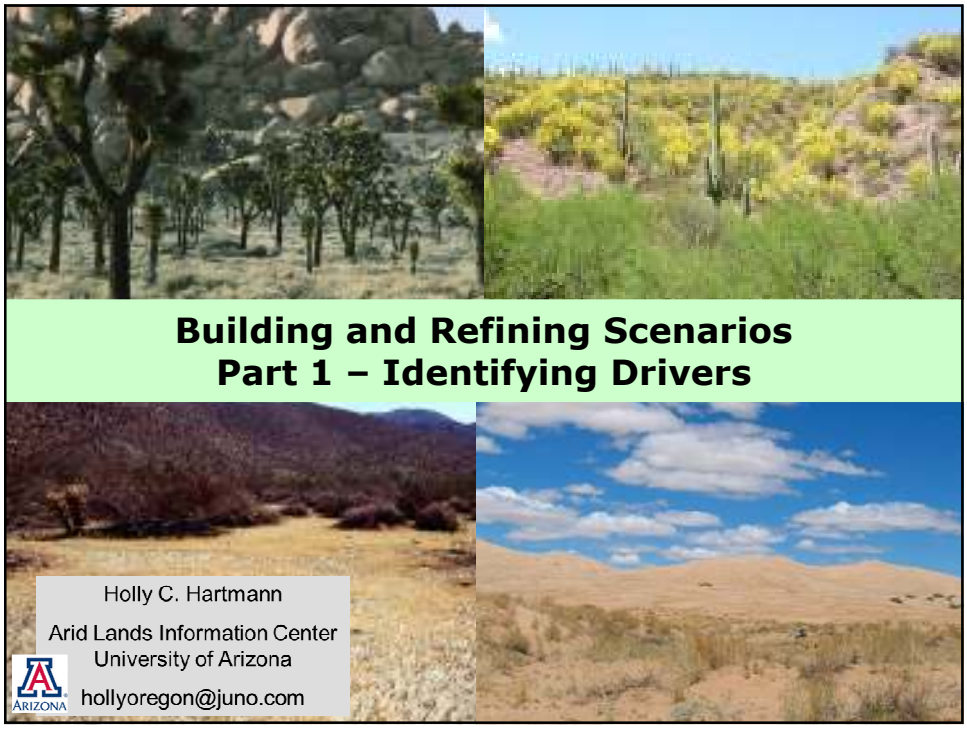

Building and Refining Scenarios
Part 1 – Identifying Drivers

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Phases in Scenario Planning

I. Preparing for the process

II. Building and refining scenarios

III. Using scenarios to evaluate, prioritize, and implement management actions

Building Scenarios

1. **Refine scope and focus question**
2. **Identify key external drivers**
3. Assess and prioritize critical drivers
4. Explore and select scenario logics
5. Develop outlines of time evolution
6. Develop scenario narratives
7. Evaluate scenarios

Challenges

Social

- Participants are safe to "think the unthinkable"
- Creative discomfort
- Efficient and effective engagement

Intellectual

- Structuring diverse information and perspectives
- Distinguishing external drivers of change from internal responses and management choices
- Tracing linkages between drivers and impacts of change

Identify Key External Drivers

Objective: to identify and document the rationale for choices in building scenarios

What could cause your system to shift to vastly different character or pose vastly different challenges?

- Consider external drivers of change
- Assess potential impacts of changes in drivers
- Consider linkages between drivers and impacts

No single method is best!

- Match with preferences, experience, time available

Methods

- Ask an expert: NOAA RISAs, DOI CSCs, National Climate Assessment
- Question assumptions behind "Official Futures"

- Discuss drivers at different scales: revisit Issue Tree
- Consider past changes, current legacies: History Wall
- Cover many types of drivers: STEEP/PESTLE Analysis

- Drivers Tables and Impacts Tables
- Influence Diagrams

Refine Scope with Key Participants

Objective: to have an explicit common focus

Focus Questions

- Initial selection can be tentative
- Continuum of possibilities: what are the impacts, are current approaches sufficient, how to manage, do objectives need to change

Activity

- Create an issue tree. Map the management challenges.

Surprises of the Past

Objective: identify past surprises in the region related to factors outside the control of managers

Recall past surprises

- Many types of surprises! Legal, social, environmental…
- Changes in understanding, too…
- Timeline
- Legacy impacts

Activity

- History Wall

PEST-STEEP-PESTLE Brainstorming

Objective: to identify all the variables that could have important impacts for your management challenge

PEST-STEEP-PESTLE

- Political
- Economic
- Sociological
- Technological
- Legal
- Environmental: includes Climate

Activity

- PESTLE Brainstorming: at least 5 drivers for each!

Methods

- Ask an expert: NOAA RISAs, DOI CSCs, National Climate Assessment
- Question assumptions behind "Official Futures"

- Discuss drivers at different scales: revisit Issue Tree
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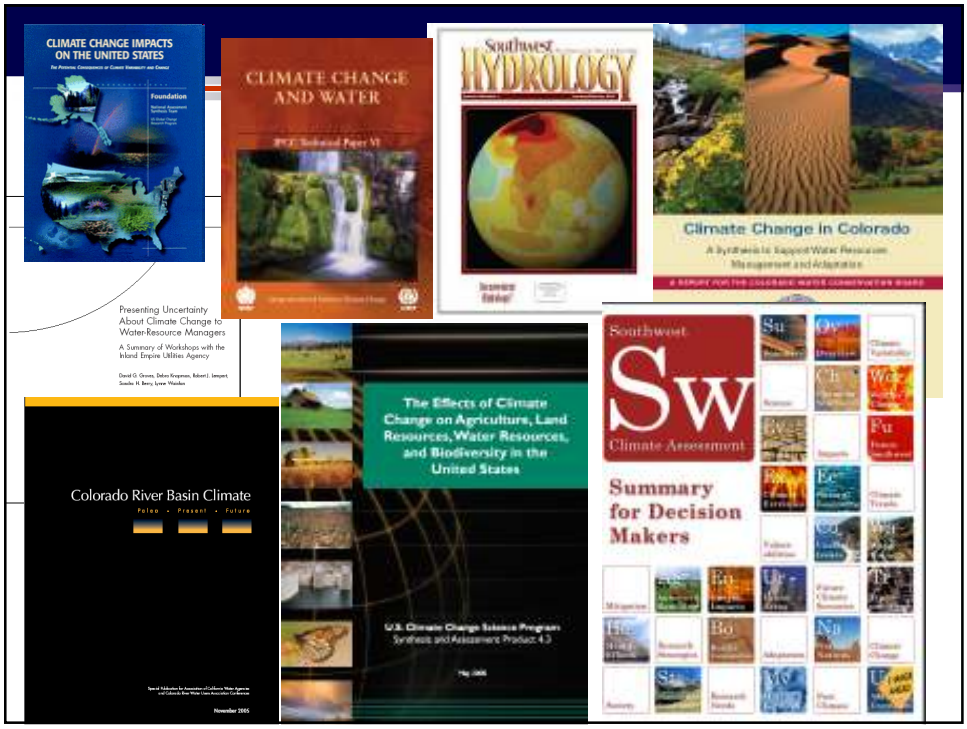
- Cover many types of drivers: STEEP/PESTLE Analysis

- **Drivers Tables and Impacts Tables**
- Influence Diagrams



Drivers Tables

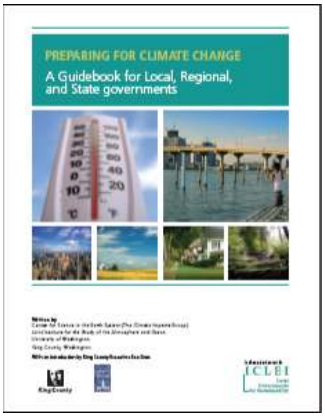
University of Washington Climate Impacts Group's Climate Change Adaptation Guidebook

CLIMATE IMPACTS GROUP
Climate Science in the Public Interest

SUMMARY OF PROJECTED CLIMATE CHANGES FOR THE U.S. PACIFIC NORTHWEST

Climate Variable	General Change Expected	Specific Change Expected and Reference Period	Size of Projected Change Compared to Recent Changes	Confidence About Seasonal Patterns of Change	Confidence	Source(s) & Context
Temperature	Increase	+0.7 to 3.2°F (2020s) +1.4 to 4.8°F (2040s) compared to 1970-1999 average	- Projected warming much larger than the regional warming observed during the 20th century. - By the 2020s, average temperatures could be higher than most of those experienced during the 19th century.	Slightly more warming in summer than winter.	High confidence that the Pacific Northwest will warm (all models project warming).	- Publications: Mote et al. 2003b - Projections derived from ten climate models from IPCC 2007 simulating climate change associated with high and low greenhouse gas emission scenarios. - Geographical region is the NW, defined as Washington, Oregon, Idaho, and western Montana.
Precipitation	Very small increase	-4 to +7% (2020s) -4 to +9% (2040s) compared to 1970-1999 average	- Projected change is very small relative to the range of precipitation observed during the 20th century.	Slight decrease in summer and slight increase in winter.	- Changes in precipitation are less certain than changes in temperature. - Changes in summer precipitation are less certain than changes in winter precipitation. - Future years projected to continue to swing between naturally wet and dry conditions, making it likely that the change due to climate change will be hard to see.	
Sea level	Increase	+7-23 inches globally at 2090-2099 compared to 1980-1999 avg. Regional variation in land movement could affect sea level rise in specific locations	- Projected changes are in the ballpark of those observed recently (7th century globally during 1961-1981 and 11th century globally during 1993-2003).	n/a	- High confidence that sea level will increase globally, but much uncertainty in the specific amount of increase and how it will vary by location. - Some uncertainty about data inputs and subsidence in South Puget Sound.	- Publication: IPCC 2007a, Meehl et al. 2005 - Projections derived from multiple climate models using fairly climate change assumptions and with high and low greenhouse gas emission scenarios.

Table 4.1 Summary table for regional climate change.



Impacts Tables

INITIAL SCOPING: A SAMPLE OF SECTORS AND POTENTIAL CLIMATE CHANGE IMPACTS	
Sector	Impacts in some regions could include…
Hydrology and water resources	• Shift in the timing of spring snowmelt to earlier in the spring • Lower summer streamflows, particularly in snowmelt-dependent water systems in the western U.S. • Increased risk of drought • Increased risk of flooding • Increased competition for water • Warmer water temperature in lakes and rivers • Changes in water quality (varies by water quality parameter)
Agriculture	• Changes in crop yields (varies by crop) • Potential ability to "double crop" • Increased risk of heat stress, particularly in the South • Increased demand for irrigation water due to longer and warmer growing season • Increased risk of pest outbreaks and weeds
Biodiversity	• Shift in the distribution and range of species • Loss of species not able to adapt to changes • Increased competition from invasive species • Loss of habitat
Forests (including parks and urban forests)	• Increase in growth and productivity in the near-term where soil moisture is adequate and fire risk is low • Shift in the distribution and range of species • Increased risk of insect outbreaks • Increased risk of forest fire • Increased competition from invasive species
Recreation	• Increased opportunities for warm season activities in milder regions of the U.S. • Decreased opportunities for warm season activities during the hottest part of the year, particularly in the southern U.S. (e.g., from heat, forest fires, low water levels, reduced urban air quality) • Reduced opportunities for cold season recreation due to decreased snowpack and/or reduced snow or ice quality • Increased reliance on snow-making at ski areas • Shifts in tourism dollars within a community from one recreation sector to another, or from communities losing recreational opportunities to communities gaining opportunities
Energy	• Reduced heating demand during winter months • Increased cooling demand during summer months • Increased or decreased hydroelectric generating capacity due to potential for higher or lower streamflows

CLIMATE IMPACTS GROUP
Climate Science in the Public Interest

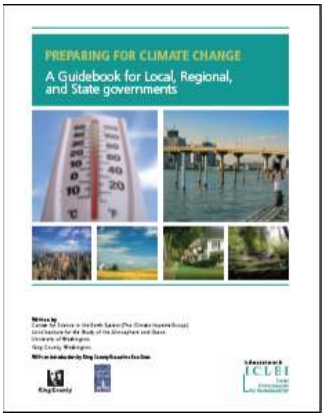


Table 4.2 Summary table for regional climate change impacts.

Joshua Tree National Park External Driver Table: Climate

SUMMARY OF PROJECTED CLIMATE CHANGES FOR JOSHUA TREE

Climate Variable	General Change Expected	Specific Change Expected & Reference Period	Size of Expected Change Compared to Recent Changes	Seasonal Patterns of Change	Confidence	Source & Context
Temperature	Increase	2050: +2 +/- 0.6°C 2100: +3.1+/- 1.1°C	Large	More pronounced in summer and early fall	>99.9% *Virtually certain*	Abatzoglou and Brown*
Precipitation	No Change / Decrease	2050: 0 +/- 2% 2100: -2.5 +/- 2.5%	Similar	More pronounced in winter and spring	Spring 99% Other seasons non-significant *Likely*	Abatzoglou and Brown*
Relative Humidity	Decrease	2050: -0.8% (-3.2 to +0.7%) 2100: -1.2% (-5.2 to 0.7%)	Large	More pronounced in spring	Spring and Summer 95% *Likely*	Abatzoglou and Brown*
Wind Speed	Increase	2050: +2% +/- 0.7% 2100: +3% +/- 1%	Large	More pronounced in winter and spring	>99% Spring >95% Annual *Likely*	Abatzoglou and Brown*
Extreme Events: Temperature	Warm Events Increase / Cold Events Decrease	2050: increase 3-6 times present; decrease to 1/5-1/3 of present 2100: increase 5-8.5 times present; decrease 1/12 to 1/8 of present	Large	Increase in frequency and length of extreme hot events (summer) greatest relative exceedances in summer, decrease in extreme cold events (winter)	Modeled and observed *Very Likely*	Abatzoglou and Brown*
Extreme Events: Precipitation	Decrease/Increase	2050: -20% to +50%	Large	Increase in frequency and	Modeled and observed	Abatzoglou and Brown*

Joshua Tree National Park Impacts Table: Climate

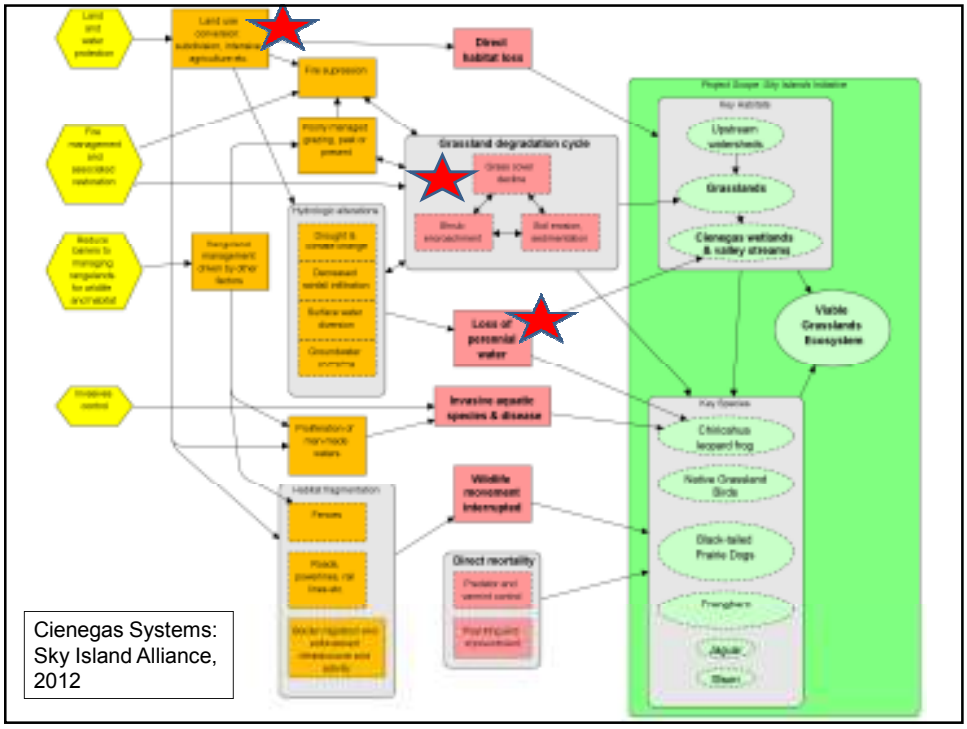
SECTORS AND POTENTIAL IMPACTS TO JOSHUA TREE		
Sector	Sub-Sector	Impacts
Natural Resources	**Hydrology & Water Resources**	**•Increase in extreme runoff and flooding (especially in winter); decrease in total snowpack; decrease in soil moisture[1]; limited surface and groundwater availability[2] •Water shortage, decrease in water quality •Link between high precipitation events and increase in invasive species to increase in fire size and spread. •Decrease in overall precipitation could lead to drought conditions. This could help eliminate the threat of invasive species as they could not cope with these conditions.**
	Aquatic Ecosystems	**•Nitrogen eutrophication; increased pollution from runoff; lower streamflows in summer; warmer stream temps; loss of habitat and species[2]**
	Vegetation	**•Changes in phenology and geographic range; increase in biomass (longer growing season)[2] •Increased invasive species •Stand-replacing fires result in loss of sources for recolonization of burned areas – e.g. it could take hundreds of years for pinyon-juniper woodland to recover (Brooks 158)**
	Wildlife	**•Changes in phenology, migration, reproduction, dormancy, and geographic range[2] •Threatened desert tortoise**
	Disturbance (fire, pests, pathogens, avalanche)	**•Fire: Increase in length of fire season, severity of fires, and number of acres burned[2]; non-native invasive grasses provide continuous fuelbeds and increase wildfire severity[1] •Pest/Pathogen: increased winter temperatures facilitate pathogen/pest survival**

Methods

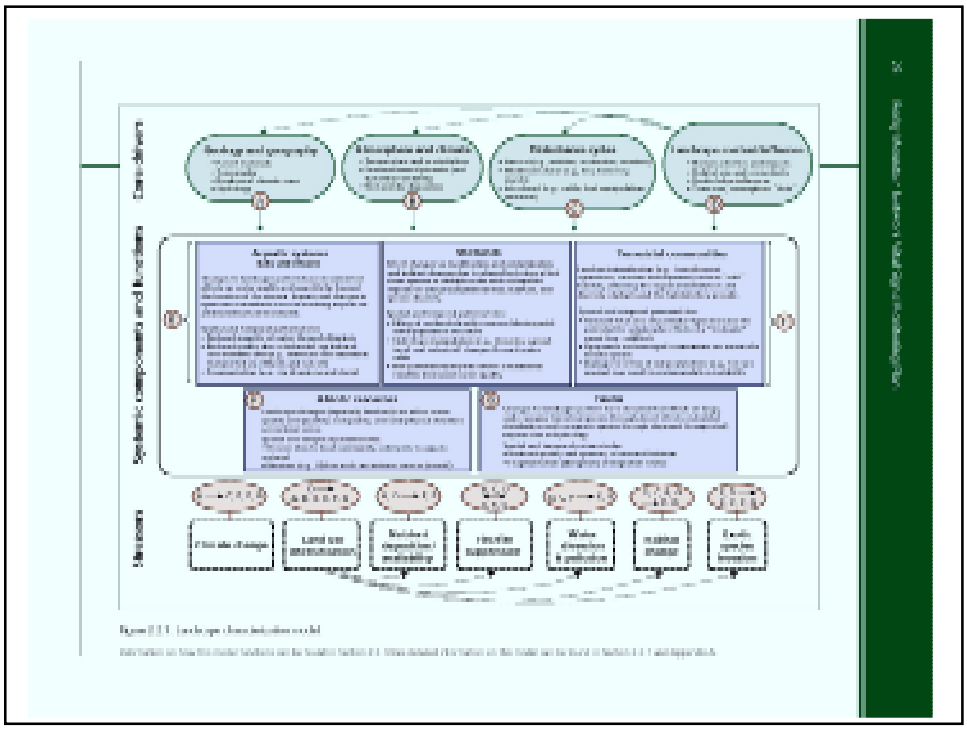
- Ask an expert: NOAA RISAs, DOI CSCs, National Climate Assessment
- Question assumptions behind "Official Futures"

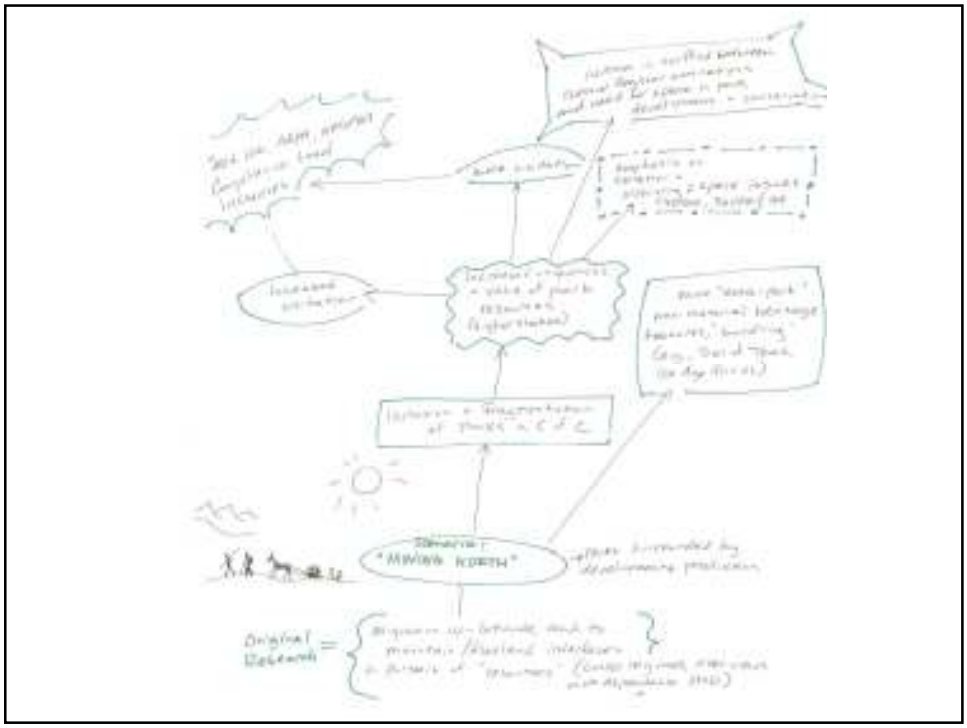
- Discuss drivers at different scales: revisit Issue Tree
- Consider past changes, current legacies: History Wall
- Cover many types of drivers: STEEP/PESTLE Analysis

- Drivers Tables and Impacts Tables
- **Influence Diagrams**



Cienegas Systems: Sky Island Alliance, 2012





Exercise


Sea Lion Cave National Seashore
Cape Everlasting
Port Pendleton
Pacific Ocean
Sea Lion Cave NS
Freeflow River
National Forest
6
4